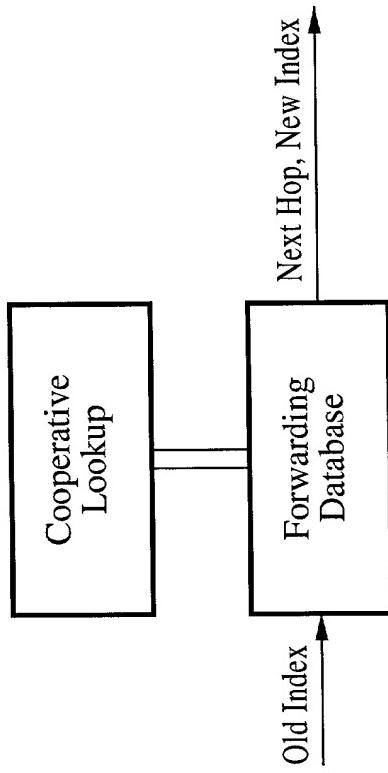
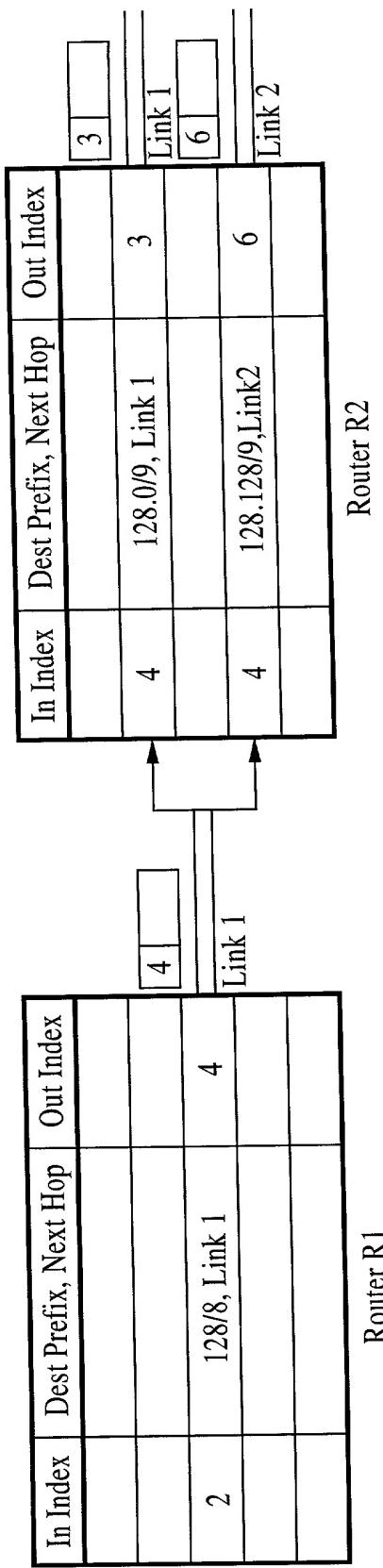
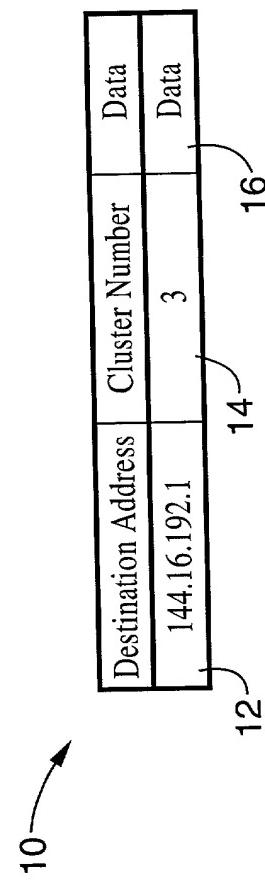
**FIG. 1****FIG. 2**

T	Schemes	Applicability	Lookup Time	Memory	Update Time	Multicast
N	Patricia	1st, 2nd upto Last Hop Router	$O(\log(n))$	Low	Low	No
O	DP Trie	1st, 2nd upto Last Hop Router	$O(\log(n))$	Low	Low	No
N	LPCTrie	1st, 2nd upto Last Hop Router	$O(\log^*(n))$	High	Low	Yes
C	Lulea	1st, 2nd upto Last Hop Router	$\ll O(\log(n))$	Low	High	No
O	CAM	1st, 2nd upto Last Hop Router	$O(1)$	—	High	Yes
P	DRAM	1st, 2nd upto Last Hop Router	$O(1)$	High	High	No
C	Tag Switching	2nd upto Last Hop Router	$O(1)$	High	High	Yes
O	MPLS	2nd upto Last Hop Router	$O(1)$	High	High	Yes
P	IP Switching	2nd upto Last Hop Router	$O(1)$	High	High	Yes
H	CLUE	2nd upto Last Hop Router	$O(1)$	High	Low	No

FIG. 3

**FIG. 4****FIG. 5**

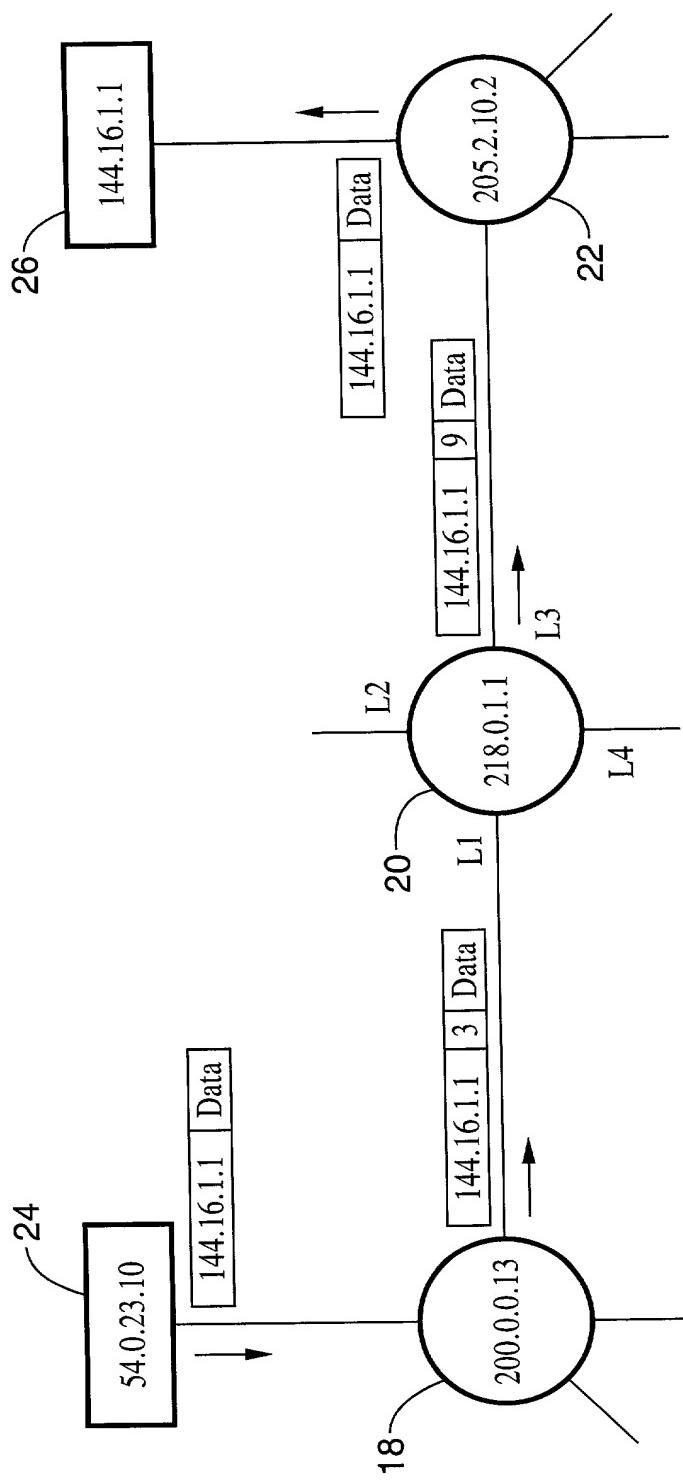
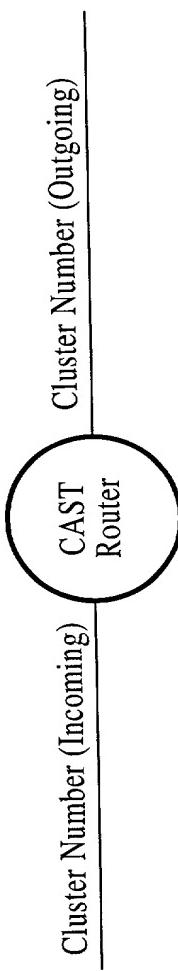
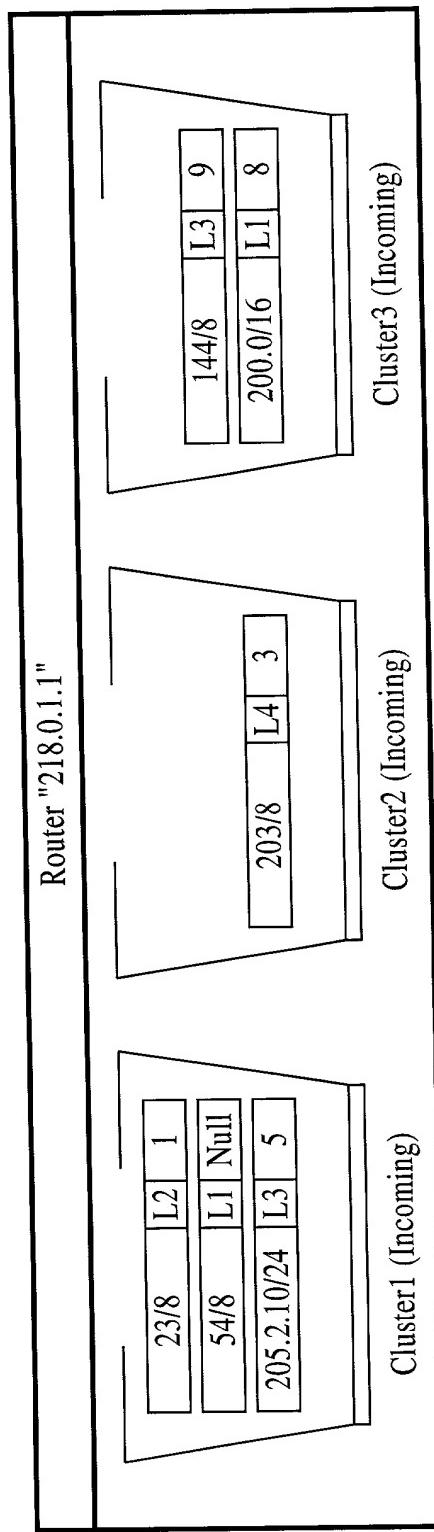
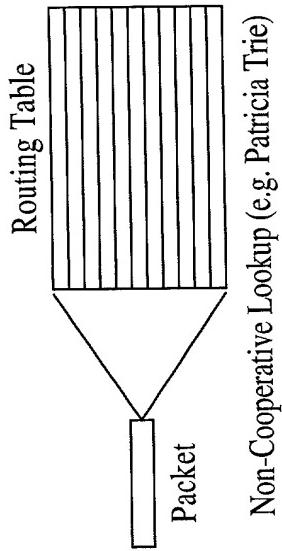
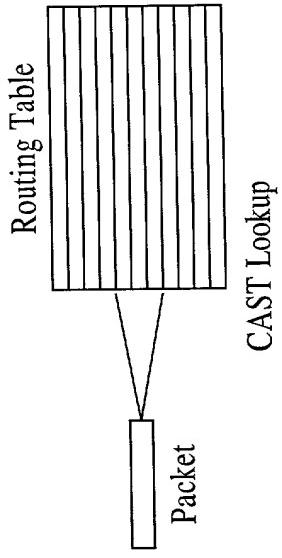
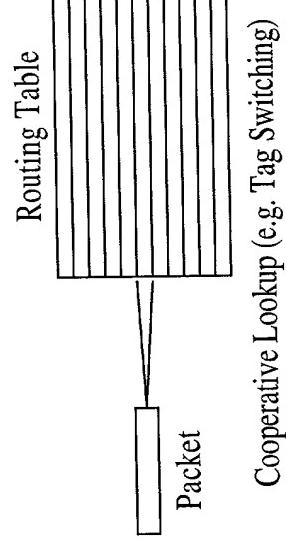


FIG. 6

**FIG. 7****FIG. 8**

Prefix Entry	Next Hop Link	Cluster Number (Outgoing)
144/8	L3	9

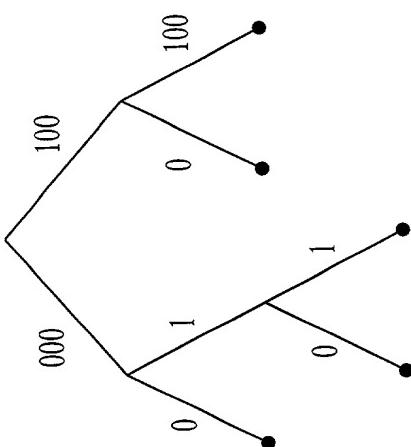
FIG. 9

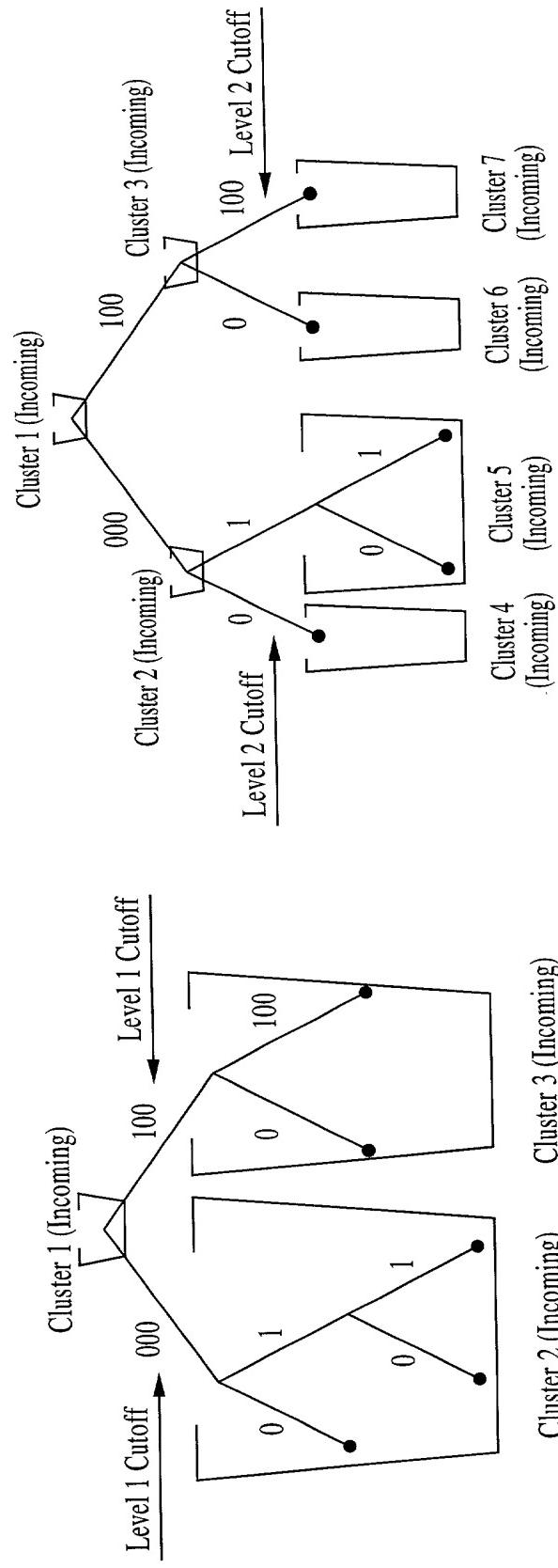
**FIG. 10A****FIG. 10B****FIG. 10C**

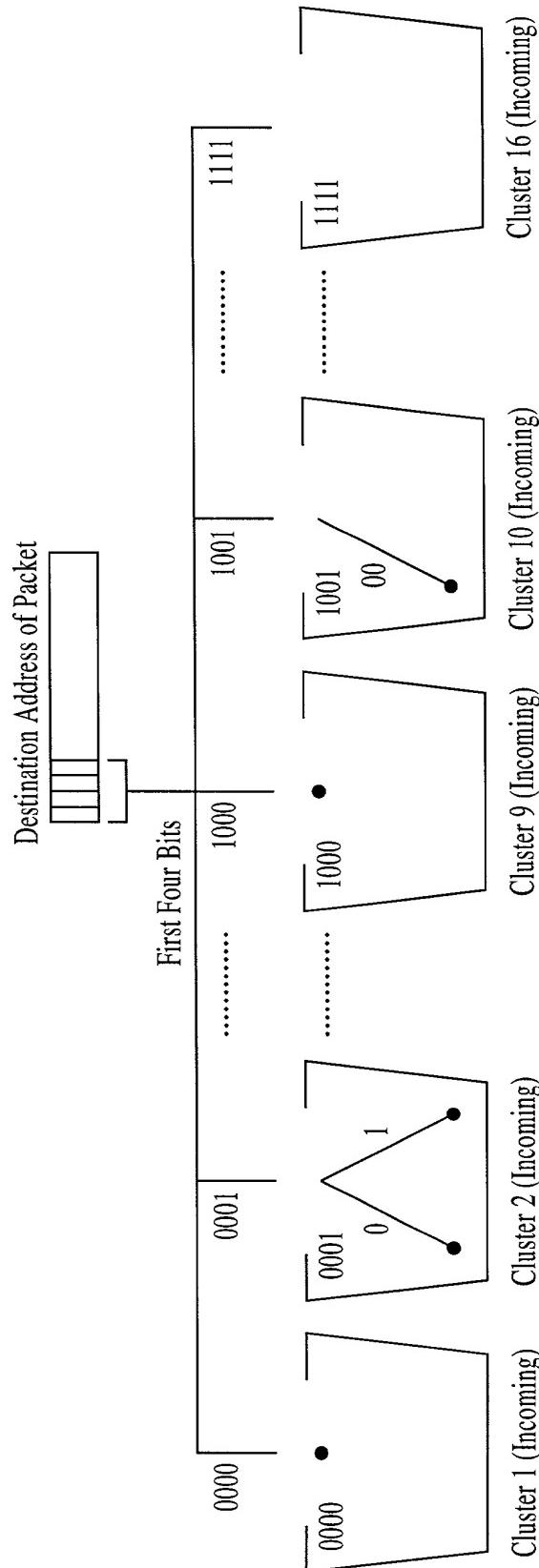
Prefix	Next Hop Link	Cluster Number (Outgoing)
0000*	L2	2
00010*	L3	3
00011*	L2	2
1000*	L1	4
100100*	L2	1

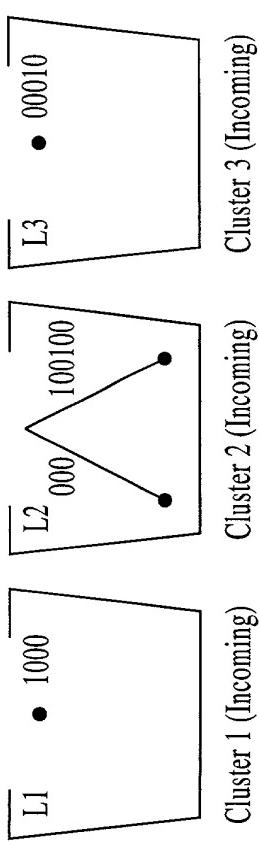
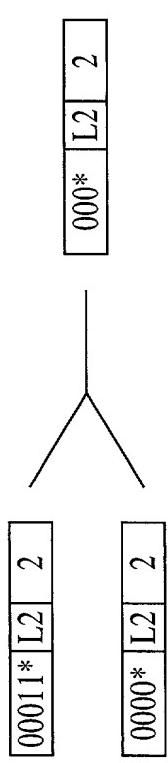
FIG. 11

Technique	Applicability
Patricia	2nd upto Last Hop Router
Symmetric	1st, 2nd upto Last Hop Router
Link	2nd upto Last Hop Router

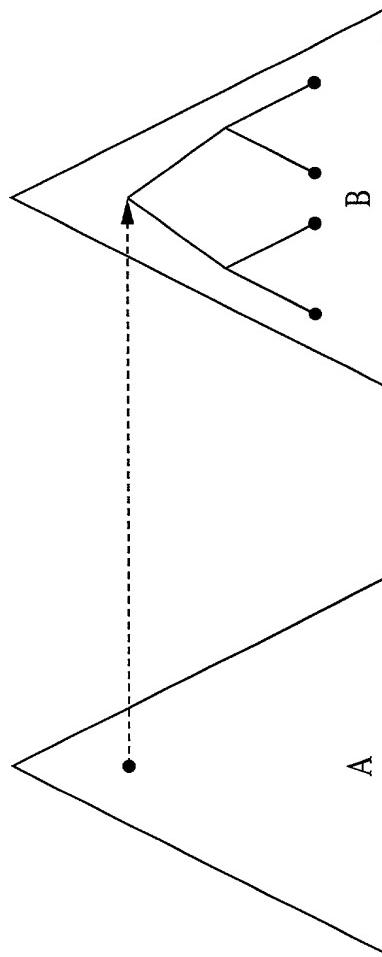
FIG. 12**FIG. 12****FIG. 13**

**FIG. 14****FIG. 15**

**FIG. 16**

**FIG. 17****FIG. 18**

```
DATA STRUCTURE
struct CAST_ROUTING_TABLE
{
    PREFIX_TABLE PT
    CONFLICT_TABLE CT
    CLUSTER_TABLE_INCOMING CTI
    CLUSTER_TABLE_OUTGOING CTO
    NEXTHOP_TABLE NT
}
```

FIG. 20A**FIG. 19**

[TABLES]

PREFIX TABLE			
CHILD	PREFIX	SKIP	POINTER (TO LEFT CHILD OR CLUSTER TABLE (OUTGOING) OR CONFLICT TABLE)
⋮	⋮	⋮	⋮
⋮	⋮	⋮	⋮
1 bit	1 bit	5 bits	17 bits

15 bits 17 bits

CLUSTER TABLE (INCOMING)	
CLUSTER NUMBER (OUTGOING)	POINTER (TO NEXT HOP TABLE)
⋮	⋮
⋮	⋮
5 bits	17 bits

CLUSTER TABLE (OUTGOING)	
CLUSTER NUMBER (OUTGOING)	POINTER (TO CLUSTER TABLE (OUTGOING))
⋮	⋮
⋮	⋮
7 bits	17 bits

NEXTHOP TABLE	
NEXTHOP	
⋮	⋮
⋮	⋮
32 bits	7 bits

FIG. 20B

```

Procedure: CAST_Forward_Packet(Packet packet)
Upon receiving an unicast packet this procedure is called in a CAST router
begin
  if((packet.cluster.no.incoming = 'Null') or packet.cluster.no.incoming doesn't exist) then
    cluster_no_symmetric ← Binary_to_decimal(packet.destination, symmetric_start_length)
    pointer_cluster_outgoing ← Search_prefix_table[cluster_no_symmetric, symmetric_start_length, packet.destination, PT, CT]
    cluster_no_outgoing ← CTO[pointer_cluster_outgoing].cluster_no_outgoing
    pointer_nexthop ← CTO[pointer_cluster_outgoing].pointer_nexthop
    nexthop ← NT[pointer_nexthop].nexthop
    Sendpacket (cluster_no_outgoing, nexthop)
  else
    patricia_start_length ← CTII[packet.cluster_no_incoming]
    pointer_cluster_outgoing ← Search_prefix_table[packet.cluster_no_incoming, patricia_start_length, packet.destination, PT, CT]
    cluster_no_outgoing ← CTO[pointer_cluster_outgoing].cluster_no_outgoing
    pointer_nexthop ← CTO[pointer_cluster_outgoing].pointer_nexthop
    nexthop ← NT[pointer_nexthop].nexthop
    Sendpacket (cluster_no_outgoing, nexthop)
  endif
end

```

FIG. 20C

DATA STRUCTURE

```
struct CAST_ROUTING_TABLE
{
    LINK-PREFIX_TABLE PT
    CONFLICT_TABLE CT
    CLUSTER_TABLE_INCOMING CTI
    CLUSTER_TABLE_OUTGOING CTO
}
```

FIG. 21A

TABLES

CLUSTER TABLE (INCOMING)			
NEXTHOP	POINTER (TO LINK-PREFIX TABLE)	CHILD	PREFIX
:	:		
32 bits	17 bits		

LINK-PREFIX TABLE			
POINTER (TO LEFT CHILD)	POINTER (TO CLUSTER TABLE (OUTGOING))	SKIP	LINK-PREFIX (TO LEFT CHILD) or CLUSTER TABLE (OUTGOING) or CONFLICT TABLE
:	:		
15 bits	17 bits	5 bits	17 bits

FIG. 21B

ALGORITHM

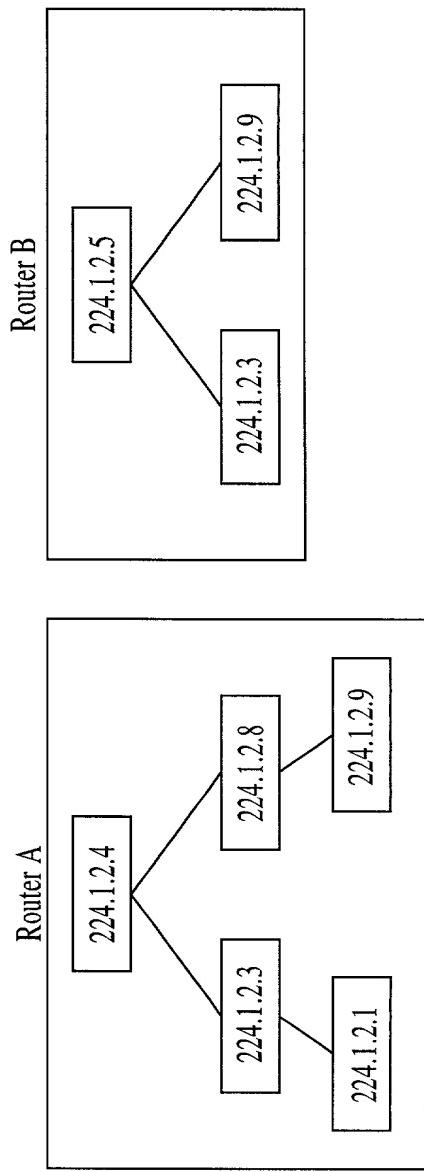
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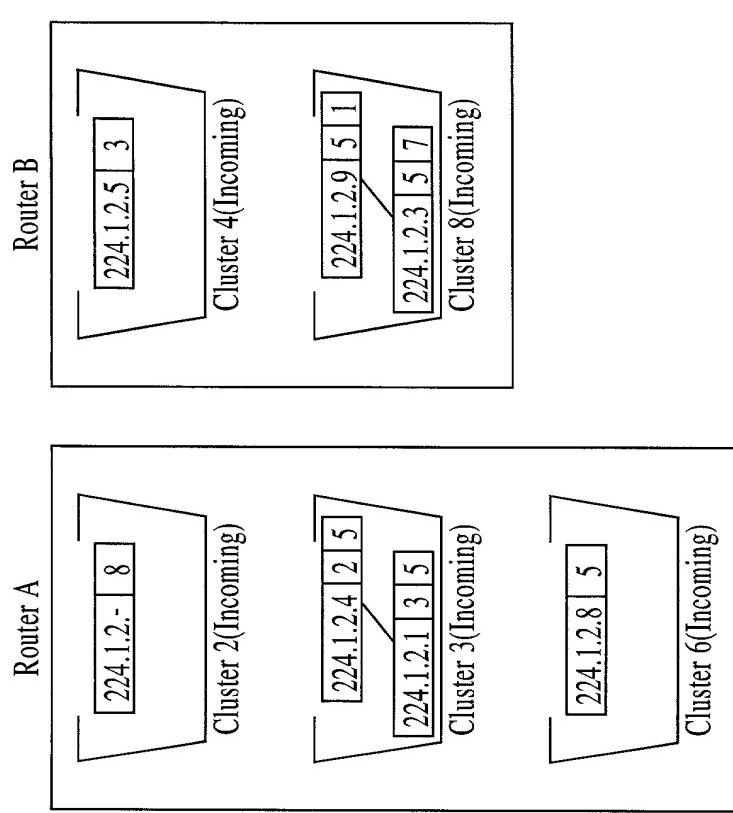
Procedure: CAST_Forward_Packet(Packet packet)
Upon receiving an unicast packet this procedure is called in a CAST router
begin
    nexthop           ← CTT[packet.cluster_no_incoming].nexthop
    pointer_link-prefix_table ← CTT[pointer_cluster_outgoing].pointer_link-prefix_table
    pointer_cluster_outgoing ← Search_link-prefix_table(pointer_link-prefix_table, 0, packet.destination, PT, CT)
    cluster_no_outgoing   ← CTO[pointer_cluster_outgoing].cluster_no_outgoing
    Sendpacket (cluster_no_outgoing, nexthop)
end
**Link Clustering**

```

FIG. 21C

Router A		Router B	
Multicast Group	Next Hop Links	Multicast Group	Next Hop Links
224.1.2.1	L1,L3	224.1.2.3	L2,L3
224.1.2.3	L2	224.1.2.5	L4
224.1.2.4	L1,L3	224.1.2.9	L2,L3
224.1.2.8	L3		
224.1.2.9	L2		

FIG. 22**FIG. 23**

**FIG. 24**

Outgoing Links	Cluster No. Incoming
L1	1
L2	2
L3	3
L1,L2	4
L1,L3	5
L2,L3	6

FIG. 25

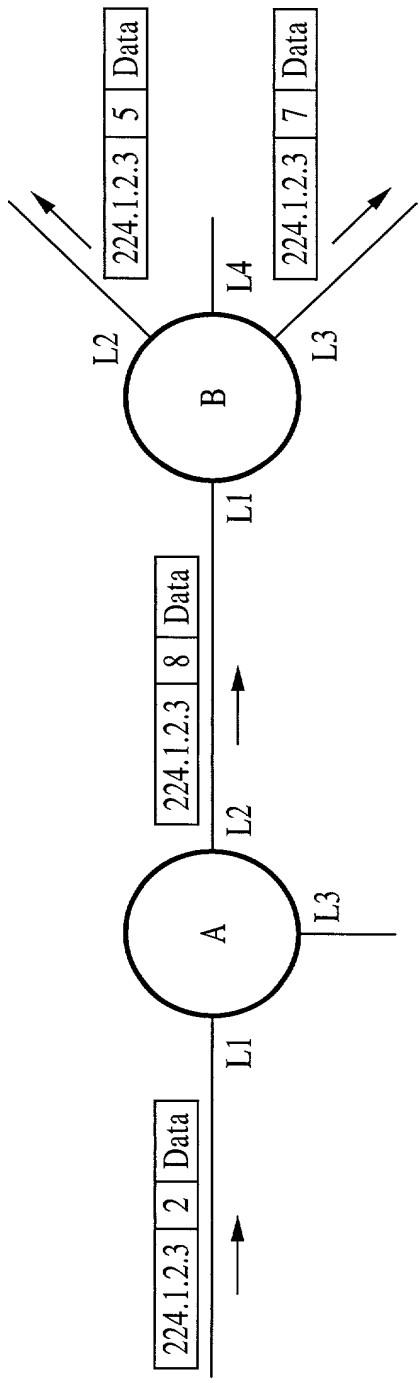
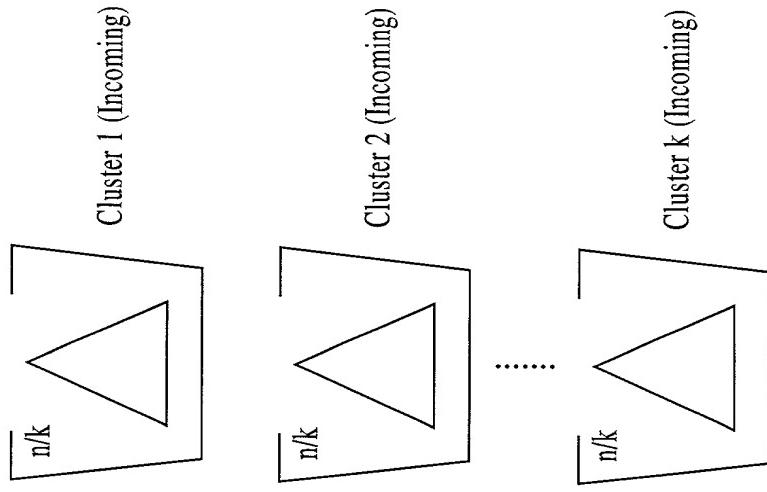
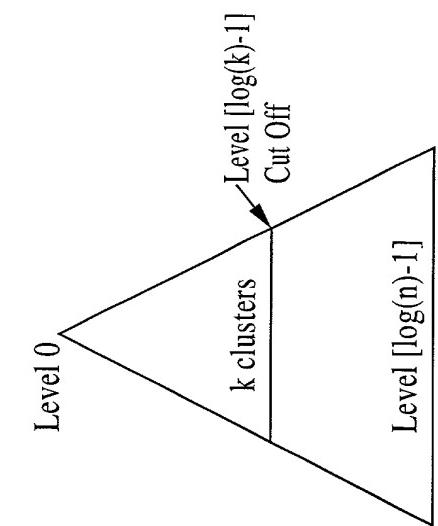
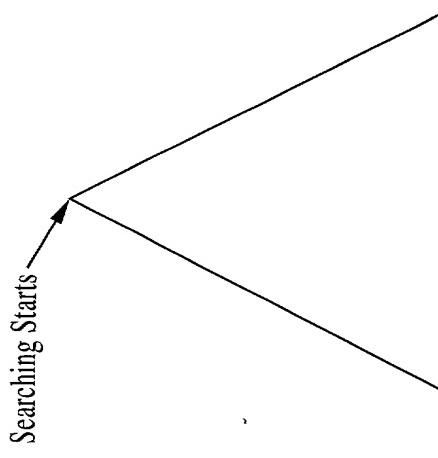


FIG. 26



FIG. 27

**FIG. 30****FIG. 29****FIG. 28**

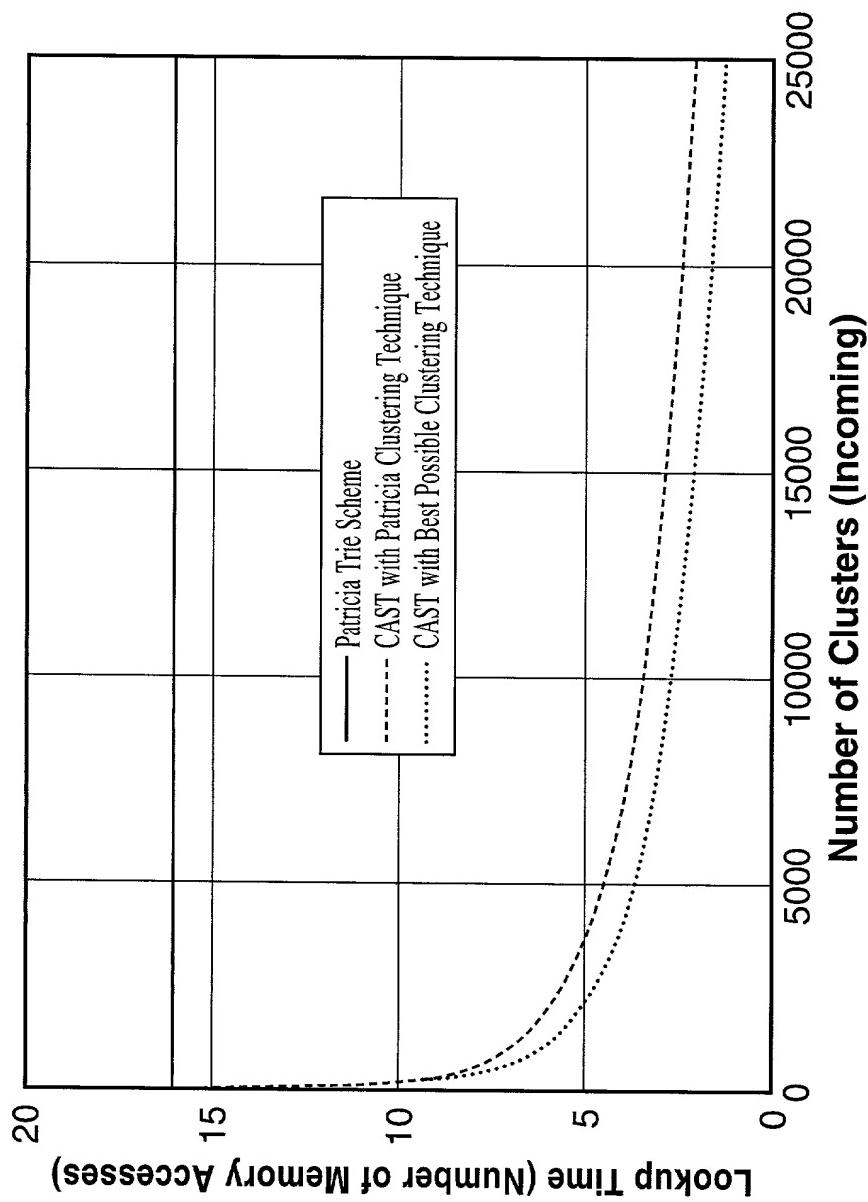


FIG. 31

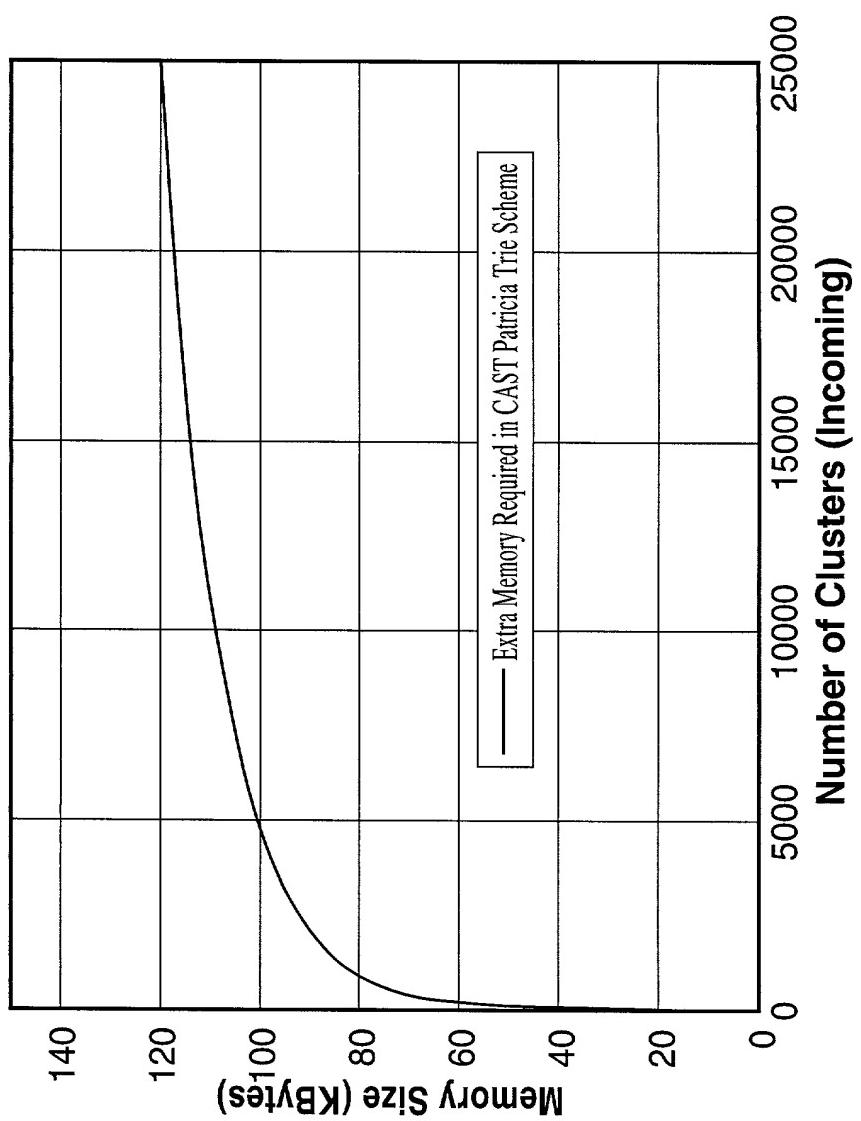
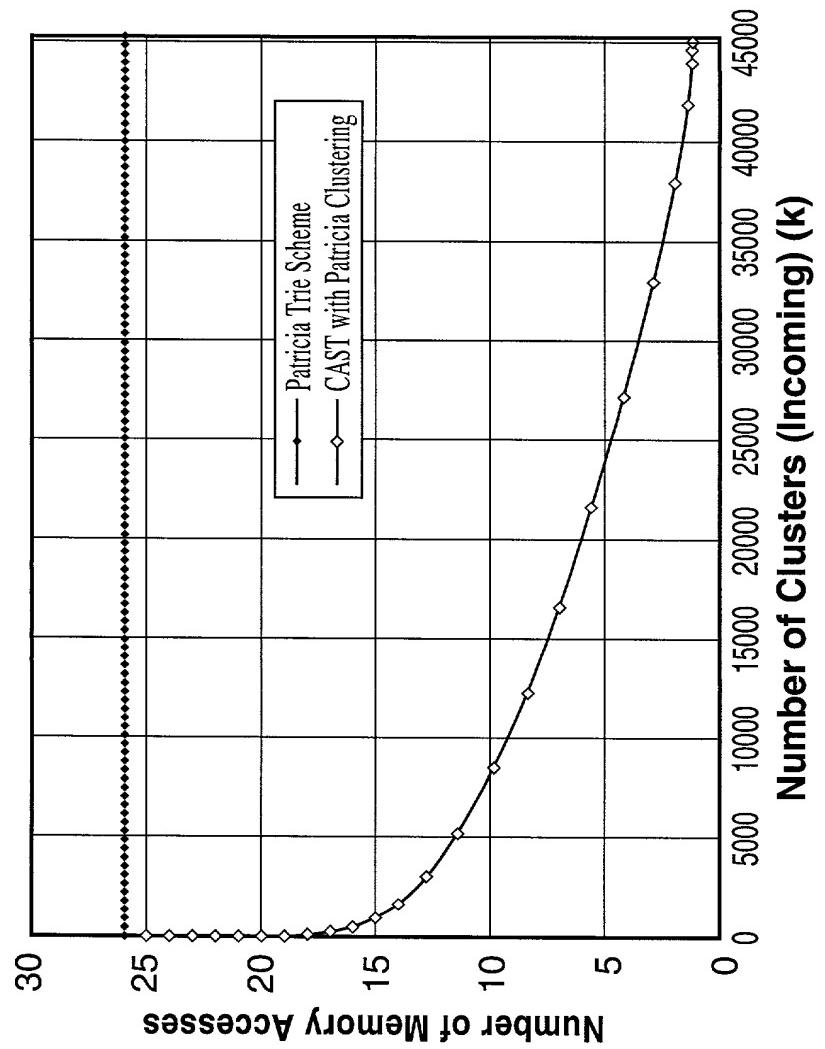


FIG. 32



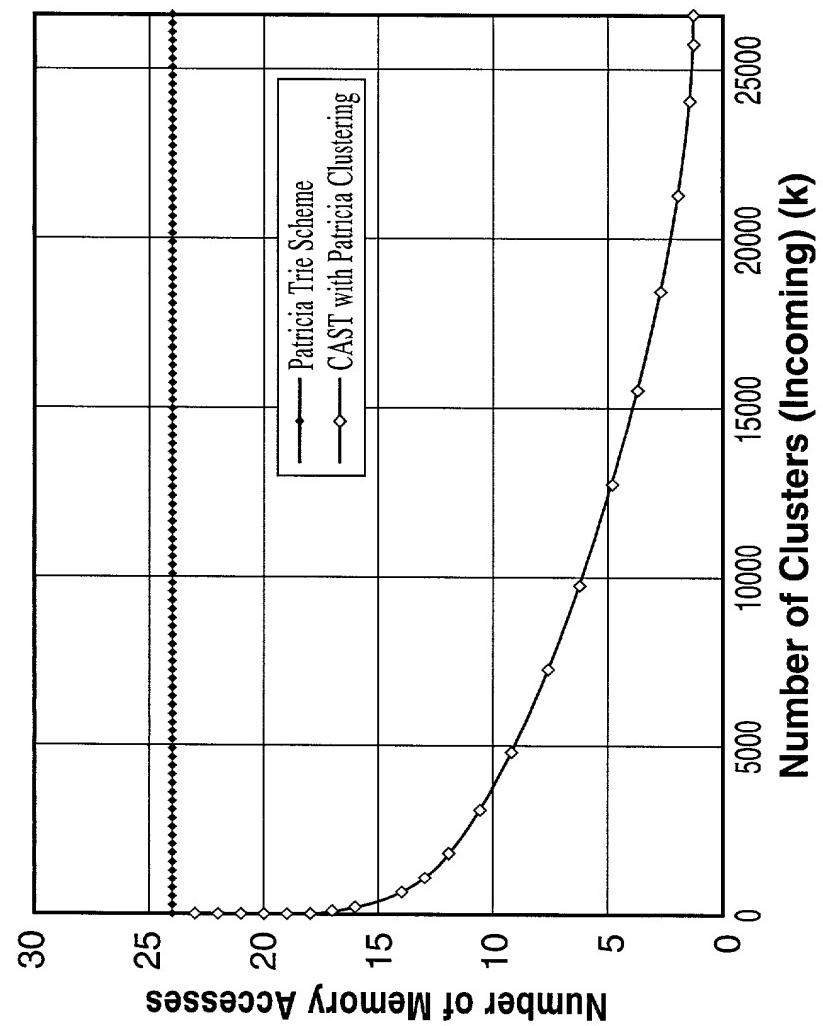


FIG. 34

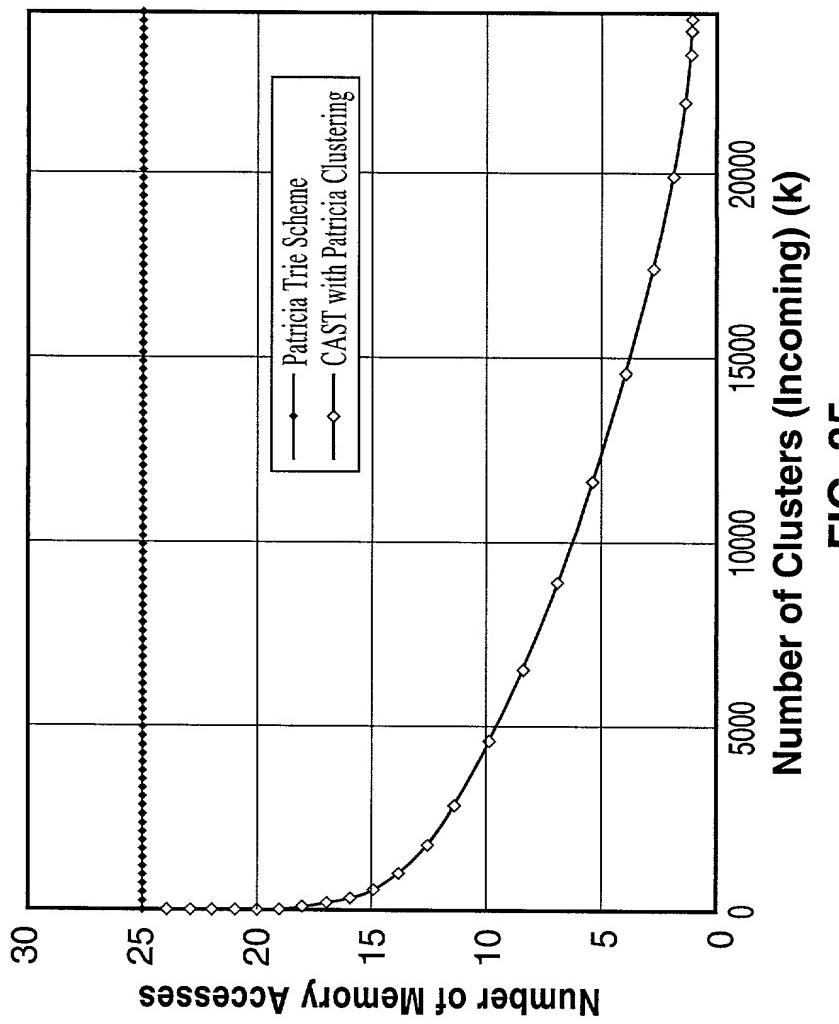
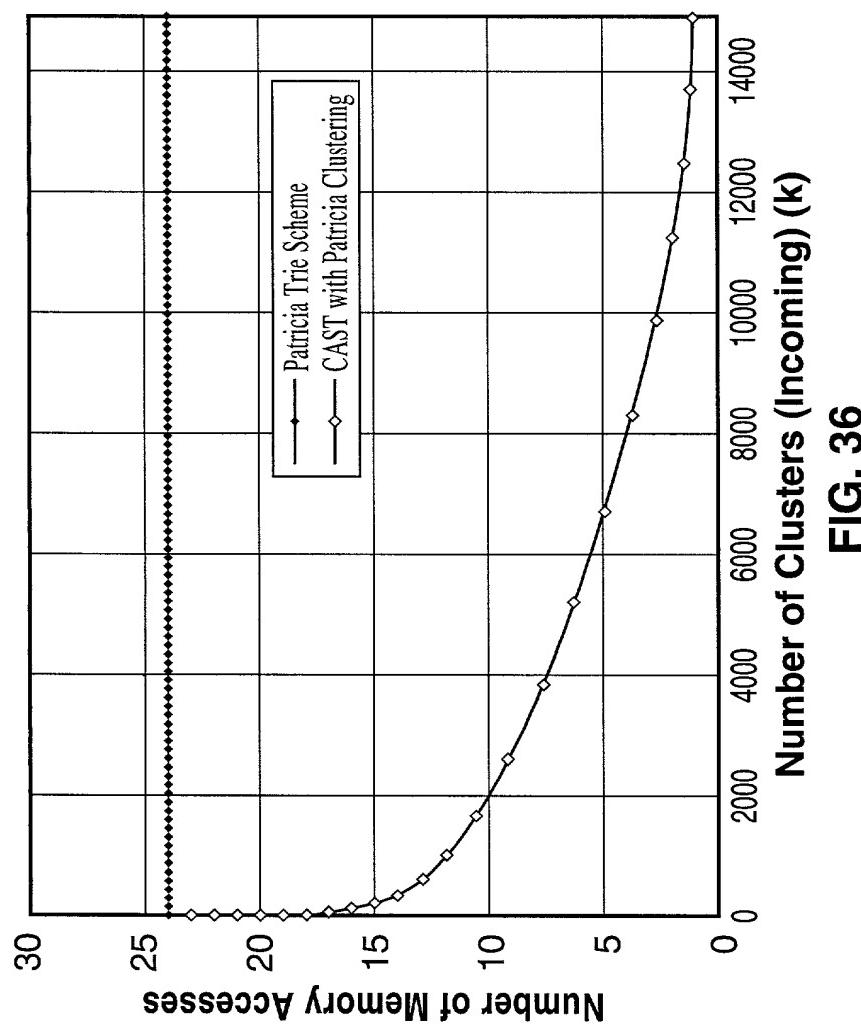


FIG. 35

**FIG. 36**

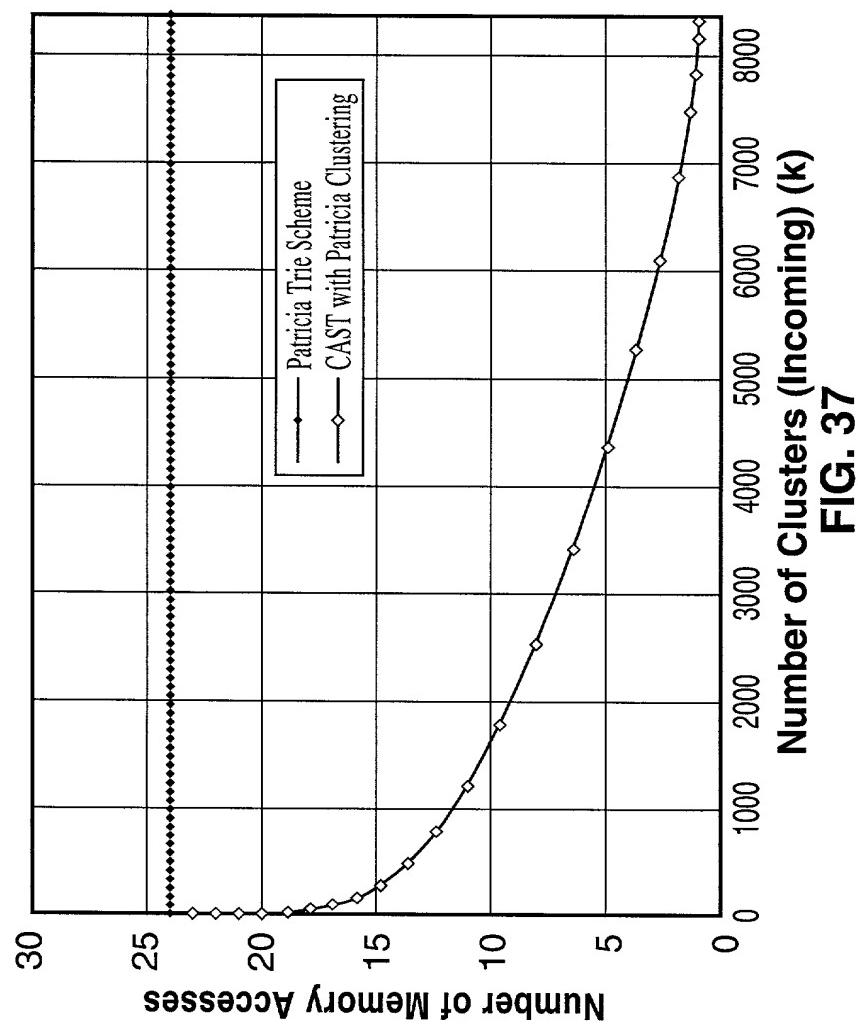


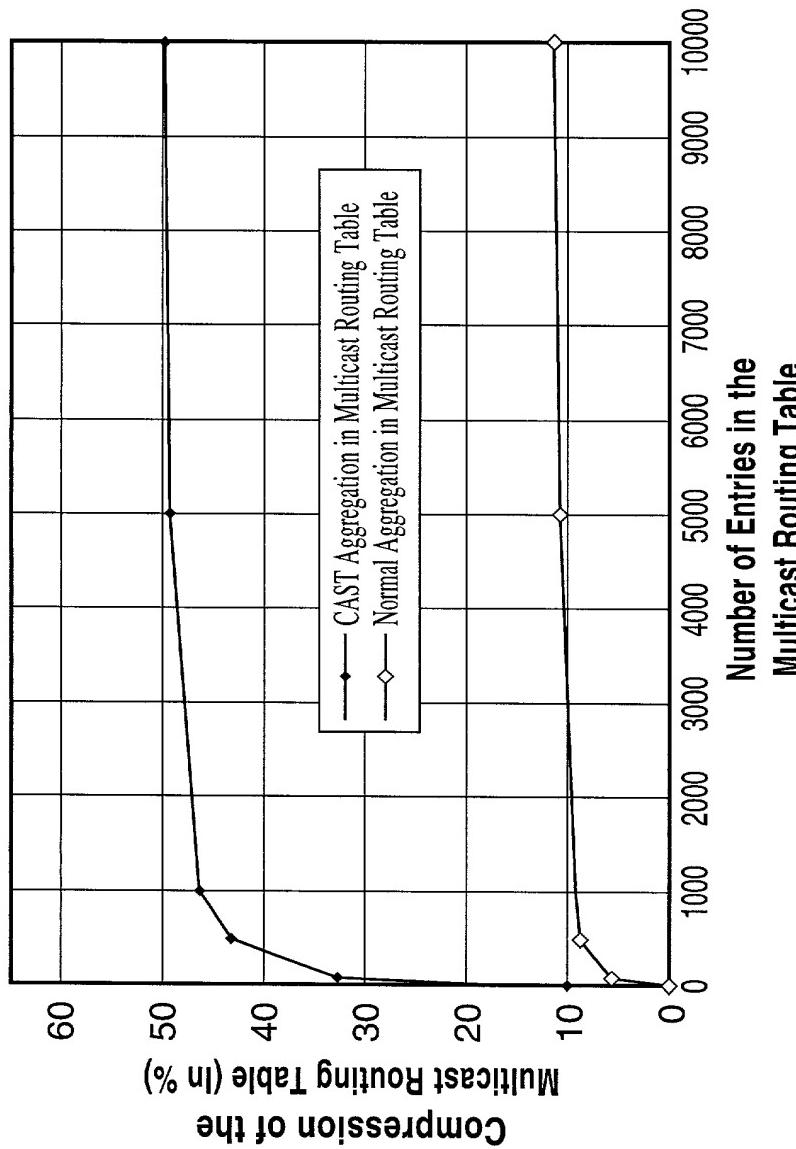
FIG. 37

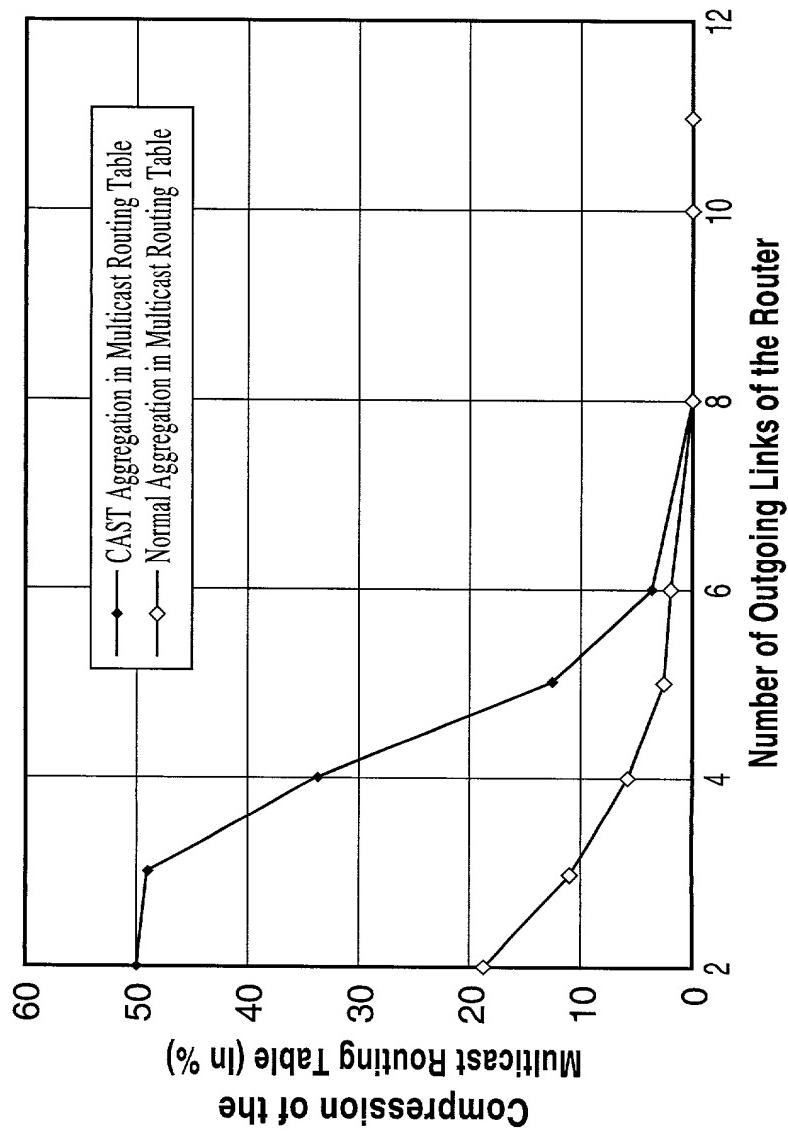
Scheme	Actual Implementation Results				
	MAE-EAST	MAE-WEST	PAC-BELL	AADS	PAIX
Patricia Trie	0.75	0.90	1.95	1.13	1.02
LPC	2.12	2.41	2.90	3.53	4.17
CAST (Patricia)	4.89	5.03	6.32	6.53	7.81
CAST (Symmetric)	0.92	1.07	2.19	1.26	1.25
CAST (Link)	0.96	1.11	2.20	1.27	1.27

FIG. 38

Scheme	Multicast Results (40,000 Entries)				
	Maximum (Memory Accesses)	Average (Memory Accesses)	Lookup Power (MPPS)	Memory (KBytes)	Update Time (Memory Accesses)
AVL Tree	16	15.21	1.31	1026	15.21
Tag Switching	1	1.00	20.00	1040	15.24
IP Switching	16	2.42	8.26	1862	30.43
CAST (Link clustering 2048 Clusters[In.])	7	4.17	23.98	889	15.18

FIG. 39

**FIG. 40**

**FIG. 41**